

**UNCLASSIFIED**



**Australian Government**

**Department of Defence**  
Science and Technology

## Notes – Openness and Evolvability – Documentation Quality Assessment

*Michael Haddy\* and Adam Sbrana (editor)*

**Maritime Division**  
**Defence Science and Technology Group**

**\*Innovation Science**

**DST-Group-TN-1545**

### **ABSTRACT**

These Research Notes form part of a series of notes extracted from work undertaken by Innovation Science in the establishment of Openness and Evolvability assessment Methods and Processes. This set of Research Notes focusses on Documentation Quality Assessment. This work was undertaken from the late 1990s to 2007 and focussed on the application to Submarine Combat Systems.

### **RELEASE LIMITATION**

*Approved for public release*

**UNCLASSIFIED**

UNCLASSIFIED

*Produced by*

*Maritime Division  
DST Group Stirling  
HMAS Stirling  
PO Box 2188 Rockingham DC WA 6967*

*Telephone: 1300 333 362*

*© Commonwealth of Australia 2016  
AR-016-664  
August 2016*

**APPROVED FOR PUBLIC RELEASE**

UNCLASSIFIED

## Contents

<b>1. INTRODUCTION.....</b>	<b>1</b>
<b>2. DOCUMENTATION QUALITY ASSESSMENT .....</b>	<b>1</b>
<b>2.1 Documentation Quality Assessment Questions .....</b>	<b>3</b>
2.1.1 Does documentation consist of more than one physical document? .....	3
2.1.2 Is consistency maintained across all documents in set?.....	3
2.1.3 Are all documents available and complete? .....	3
2.1.4 Is navigation between documents clear? .....	3
2.1.5 Do unassessed documents remain in set?.....	4
2.1.6 Select a document that has not yet been assessed. ....	4
2.1.7 Initialise penalty points for document to zero. ....	4
2.1.8 Any issues with spelling, grammar or punctuation? .....	4
2.1.9 Any issues with sentence structure? .....	5
2.1.10 Is the layout and style clear and consistent?.....	5
2.1.11 Are illustrations relevant, consistent and clear? .....	6
2.1.12 Is translation to English clear? .....	6
2.1.13 Is vocabulary consistent and glossary complete? .....	6
2.1.14 Do quality Table of Contents and Index exist? .....	6
2.1.15 Is history of change management evident? .....	8
2.1.16 Are internal and external references complete and accurate? .....	8
2.1.17 Has IV&V been conducted on document?.....	8
2.1.18 Has document passed IV&V? .....	8
2.1.19 Is language clear and unambiguous? .....	8
2.1.20 Penalty Points for any document $\geq 10$ ?.....	9
2.1.21 Penalty Points for any document $\geq 6$ ? .....	9
2.1.22 Penalty Points for any document $\geq 2$ ? .....	9
<b>3. REFERENCES .....</b>	<b>10</b>

*This page is intentionally blank*

## 1. Introduction

These Research Notes have been extracted from work undertaken by Innovation Science under contract to Defence Science and Technology Group during the period from the late 1990s until early 2007.

In entirety the Research Notes form a subset of the overall assessment Methodology and Processes developed to assess system level Openness and Evolvability.

The Research Notes within this report focus on Documentation Quality Assessment.

## 2. Documentation Quality Assessment

This process should be used to gauge the quality of documentation being assessed as part of the Standards, Architecture, Infrastructure and Interface assessment categories. The document assessment considers either a single or group of related documents.

If a large number of closely related documents require assessment, it is acceptable to select a random sample of documents that fall into the following three categories, [1]:

- the seven largest documents in the set
- the seven smallest documents in the set
- seven documents of average size.

If fewer than 21 documents exist in the set, then a thorough assessment should consider them all.

Many of the document assessment metrics result in the allocation of a “maximum score” as well as a “penalty point” score. The maximum score applies to the overall document quality score. However, the penalty point system is calculated for each individual document, regardless of the number of documents that combine to form the set of documentation. Each of the penalty point scores are considered after first evaluating each of the documents in the set.

If a maximum score is encountered, that score is the best score that can be awarded as the documentation quality score for the documentation being assessed. The assessment should continue however, as the final score may ultimately be lower than the interim maximum score.

The flowcharts shown in Figure 1 and Figure 2 summarise the assessment process. Each question within the flowchart is explained in greater detail in the sections that follow.

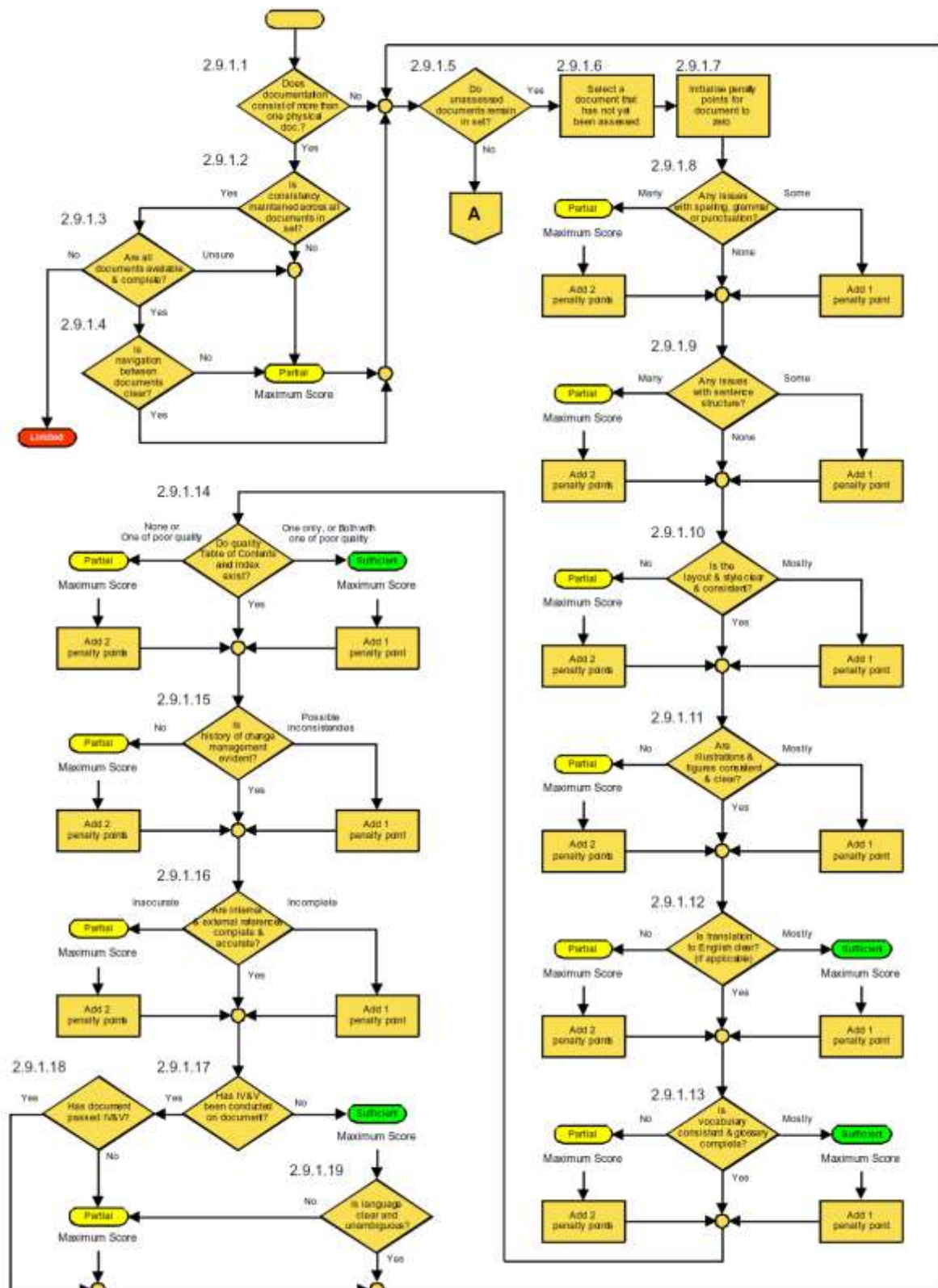


Figure 1. Documentation Quality Assessment Flowchart (1 of 2)

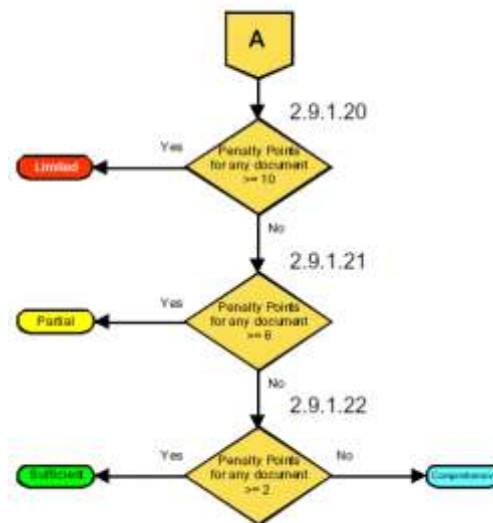


Figure 2. Documentation Quality Assessment Flowchart (2 of 2)

## 2.1 Documentation Quality Assessment Questions

### 2.1.1 Does documentation consist of more than one physical document?

If more than one document combines to form the documentation being assessed, the set of documents need to be assessed for their consistency, completeness and the ability to readily navigate between the documents in the set.

### 2.1.2 Is consistency maintained across all documents in set?

Focusing only on the overall style, layout and presentation of the documents, are the documents consistent? A lack of consistency between documents can lead to confusion, and adversely affects usability and documentation maintenance [2].

### 2.1.3 Are all documents available and complete?

If it is clear that documents are missing from the set, the assessment must immediately apply the lowest score to the documentation set. Missing documentation is likely to make it virtually impossible for a third-party to independently use the remainder of the documentation to independently achieve the same interpretation as the original vendor.

### 2.1.4 Is navigation between documents clear?

If it appears as though the set of documents are complete, but it is unclear how the documents in the set relate to one another, then a third-party will find it difficult to ensure they locate sufficient information to achieve the same interpretation as the original vendor. The document set is therefore marked poorly.

### 2.1.5 Do unassessed documents remain in set?

If multiple documents are being assessed as a single set, and more documents exist that have not yet been checked, then progress to 2.9.1.6 (section 2.1.6); otherwise, skip to 2.9.12.20 (section 2.1.20). Note that if a large number of documents combine to form the set, only a random subset of the documents require assessment, provided an equivalent number of random samples are selected from the smallest, largest and average sized documents within the set.

### 2.1.6 Select a document that has not yet been assessed.

Choose a previously unassessed document from the set of documents to begin a detailed assessment.

### 2.1.7 Initialise penalty points for document to zero.

Penalty points may be accumulated by each document during the assessment process. Each assessment criteria adds either zero, one or two penalty points to a single document's assessment. Once each of the assessment criteria have been considered for a given document, the total number of penalty points should be recorded so that it can be considered later in the overall document quality assessment.

### 2.1.8 Any issues with spelling, grammar or punctuation?

Read randomly selected paragraphs drawn from a cross-section of the document and judge the accuracy of the document's spelling, grammar and punctuation. Incorrect punctuation or grammar can make the document cumbersome and difficult to read, and can sometimes lead to multiple interpretations. While considerable latitude needs to be given to permit different writing styles, this assessment is primarily concerned with identifying issues with spelling, grammar or punctuation that introduce ambiguity or that make the document difficult to read.

In terms of punctuation, focus should be directed towards the correct use of full stops, commas, semi-colons, colons, dashes and parentheses. Both underuse and overuse should be noted, although an occasional indiscretion should be overlooked unless it gives rise to ambiguity. Sentences that do not adequately resolve ambiguity should be flagged as significant risks.

For example, consider the following ambiguously constructed sentence:

"In the event of a discrepancy, the message shall be sent to Goliath, the central server and main message repository."

Unless the reader already has intimate knowledge of the system architecture, it is quite conceivable that the sentence could be interpreted with one of at least four meanings:

1. The message should be sent to "Goliath", which is the central server and main message repository



2. The message should be sent to both “Goliath” (which is the central server), and the message repository
3. The message should be sent to “Goliath” as well as to the central server and message repository (which are one and the same)

or

4. The message should be sent to “Goliath” as well as to both the central server and message repository.

#### 2.1.9 Any issues with sentence structure?

Poorly chosen sentence structure reduces readability. This metric is closely related to the use of punctuation, but is essentially focused on determining whether or not sentences within the document follow expected rules. The documentation being assessed is usually technical or academic in nature. Hence, journalistic tendencies (such as fragmented sentences that are sometimes included for dramatic effect) are usually inappropriate.

Issues to look out for include:

1. Dependent clauses: Two or more dependent clauses written as separate sentences that would be more easily understood if they were revised, and possibly also rearranged, to form a single sentence with appropriate punctuation. [3][4]
2. Fragmentation: Sentences without a main verb or subject. [4]
3. Independent clauses: A sentence containing two or more independent phrases that have not been connected using an appropriate dependent marker, or that would be more easily understood if they were written as separate sentences. [5]

#### 2.1.10 Is the layout and style clear and consistent?

Inconsistent layout and style makes it difficult to navigate the documentation. The implicit hierarchy of information within the documentation may also be lost if consistency is not maintained.

Evaluate the document for consistency in terms of:

- font (size and typeface)
- use of emphasis (font size, weight, colour, italics and underline)
- paragraph alignment (left, right, centre or fully justified)
- indentation
- heading styles and numbering
- use of footnotes and side bars
- figure, table and equation captioning
- overall page layout (including headers and footers).

### 2.1.11 Are illustrations relevant, consistent and clear?

Diagrams, illustrations and figures can offer a rapid method to convey complex information. However, they should aim to provide support to a related block of text rather than to exist in place of a textual explanation [6]. Furthermore, visuals should be functional, consistent and clear in order to achieve greatest value to the reader.

Evaluate the document for consistency between illustrations (where appropriate). Look for clear linkages between the text and associated visuals. Determine if the visuals successfully enhance the accompanying text or if they have been inserted in isolation. Consider the complexity of the visuals: Are supplementary visuals used to explain or detail parts of a higher-level visual, or is too much detail contained in a single visual?

### 2.1.12 Is translation to English clear?

This question is relevant only if the document has been translated from another language. Translated technical documents risk introducing ambiguities and multiple interpretations in the English version that were not present in the native language version. The complex and non-linear correlations between words of different languages make the task of accurately translating documentation particularly difficult. Regardless of this difficulty, the fact remains that a poorly translated document introduces a substantial risk that the translated document will be misinterpreted by native speakers of the resulting language.

### 2.1.13 Is vocabulary consistent and glossary complete?

Many technical documents will introduce abbreviations and acronyms to avoid repeating long strings of words throughout a document. It is important that these terms are both appropriately defined when they are first used within the document, and (more importantly for reference documents<sup>1</sup>) included within a glossary at an easily located position within the document.

### 2.1.14 Do quality Table of Contents and Index exist?

Although this question literally asks for the existence of a Table of Contents and Index, a penalty should be applied if the quality of these elements is poor. Hence, even if both a Table of Contents and Index exist within the document, if the quality of one or both is poor, the metric should be scored as if the poor quality elements are missing.

Easy navigation within the document is enhanced through the presence of both a Table of Contents and Index. Most word processing and publishing programs offer straightforward methods to automatically generate a Table of Contents. However, constructing a usable Index usually requires good planning and some manual effort.

A sufficient Table of Contents would include a number of heading levels that is appropriate to the complexity of the document. If the document is particularly complex,

---

<sup>1</sup> Reference documents are often not read in a specific order. Relying on an acronym definition being present at its first use within the document may make it difficult for a reference user to locate the appropriate meaning of the acronym. Reference documents should therefore always contain a glossary of such terms

with many heading levels, the use of an Index to supplement a shorter Table of Contents would be preferable over the blanket construction of a very long Table of Contents containing many low-level headings. However, a complex document with only top-level headings in its Table of Contents would be equally inappropriate.

Before evaluating the Index, attempt to identify several topics derived from reading other parts of the document, and search for those topics using the index. A good quality index should point to the introduction of the topic as well as supplementary usage (if appropriate). Ideally, the index should emphasise (e.g. bold) the page numbers of the most significant references for common topic words. The index should also include inverted references and sub-entries to index topics that are often described using multiple words (e.g. "ethernet network" should also be listed under "network" with a sub-entry, "ethernet").

The following set of rules have been provided for guidance purposes only. These rules have been derived from usability testing [7], and are included within this assessment as an example of how a good quality index could be constructed. Other methods may be equally appropriate, and the assessor should make a judgement as to the success of the index in the context of the document's target domain and audience.

Suggested rules for creating quality indexes [7] are summarised in the following list.

- Indexes should include chapter titles, concepts, proper names, terms, titles, relationships, and subheadings as entries
- Indentation should be used instead of run-on styles
- Long entries that wrap over multiple lines should be avoided
- Main entries should include sub-entries for all items discussed under the main entry topic except for titles and proper names
- Main entries should avoid having specific page references when sub-entries exist for the main entry
- Main entries should nominate page spreads (e.g. p50-55) to identify areas of primary discussion for the main entry topic
- Sub-entries should be present for any topic that has a large number (5 or more) of page references
- Main entries should exist for detailed discussions continuing for 10 pages or more
- Prepositions and conjunctions should be avoided within sub-entries
- Sub-entries should also be listed as top-level entries (double-posting)
- Acronyms should be included in the index
- Sub-entries should be phrased to avoid commas, where possible (e.g. "test data creation" rather than "test data, creating").

### 2.1.15 Is history of change management evident?

Documents that include a well-maintained change history give confidence to the reader that the information contained within the document is up-to-date. The change history may or may not include a summary of topics affected by each change, but should include (as a minimum) the release date and version number of the resulting document. Depending on the type of document (how technical and its intended audience), change bars may also enhance reader confidence levels.

If a change history is present, look for evidence that it has been kept up-to-date.

### 2.1.16 Are internal and external references complete and accurate?

Accurate cross-referencing is critical to the user being able to quickly navigate the document (or set of documents). Missing or inaccurate cross-references greatly decrease usability.

References should include:

- Page and/or section cross-references where there is a clear need to relate two sections of the document
- Page and/or section cross-references to common areas of the document to avoid duplication of common information
- A list of closely related documents (particularly when the document forms part of a set)
- Bibliographical references to previously published documents.

### 2.1.17 Has IV&V been conducted on document?

If Independent Verification and Validation (IV&V) has been performed on the document, the assessment can assume the IV&V activities addressed the technical validity of the document. If evidence of IV&V has been performed, go to 2.1.18 (section 2.1.18); Otherwise, consider the document in greater detail via question 2.1.19 (section 2.1.19).

### 2.1.18 Has document passed IV&V?

An external assessment of the document should be able to be distilled down to a binary pass/fail mark. Use the independent verification and validation assessment to determine whether or not the document has achieved its technical aim.

### 2.1.19 Is language clear and unambiguous?

An independent verification and validation exercise has not been conducted on the document. However, it is unlikely that the openness assessment will have the time or resources to conduct such an activity. Hence, the assessor should randomly select a chapter of the document (or equivalent) and gauge the ease with which they can understand the contents based on the language used and whether or not the meaning

appears ambiguous. Consideration should be given to the intended audience and the level of assumed knowledge implied by such an audience — particularly when the assessor is not an expert in the subject area.

#### 2.1.20 Penalty Points for any document $\geq 10$ ?

If any of the penalty point totals derived for individual documents in the set is equal to ten (10) or more, the document is deemed to contain serious flaws and is awarded the lowest score.

#### 2.1.21 Penalty Points for any document $\geq 6$ ?

If any of the penalty point totals derived for individual documents in the set is between 6 and 9, the document is deemed to contain too many flaws to be sufficient for a third-party to use the document in isolation of the author, with confidence that they will correctly understand and interpret its content.

#### 2.1.22 Penalty Points for any document $\geq 2$ ?

If any of the penalty point totals derived for individual documents in the set is between 2 and 5, the document is flagged as requiring improvement, but is still more than likely sufficient to allow a third-party to use the document in isolation of the author and maintain a consistent interpretation of its content.

If the penalty point totals are all less than 2 (either zero or one), any issues with the documentation are considered minor and are unlikely to pose any risk to third-party interpretation of the document contents.

### 3. References

1. Martin, Robert A. and Drozd, Mary T., *Using Product Quality Assessment to Broaden the Evaluation of Software Engineering Capability*, Presented at the 1996 Software Engineering Process Group (SEPG) Conference, 20-23 May 1996, Mitre Corporation, MA USA, [http://www.mitre.org/work/tech\\_transfer/pdf/se\\_capability.pdf](http://www.mitre.org/work/tech_transfer/pdf/se_capability.pdf), 1996
2. USDATA Corporation - *Adobe Customer Spotlight*, Adobe Corporation, <http://www.adobe.com/print/spotlights/frmusdata/pdfs/usdata.pdf>, 1997.
3. *Sentence Fragments*, Owl Online Writing Lab, Purdue University, [http://owl.english.purdue.edu/handouts/grammar/g\\_frag.html](http://owl.english.purdue.edu/handouts/grammar/g_frag.html), Accessed November 2007.
4. *Independent and Dependent Clauses*, The Owl at Purdue, Purdue University, USA, <http://owl.english.purdue.edu/owl/resource/598/01/>, Accessed November 2007.
5. *Sentence Punctuation*, The Owl at Purdue, Purdue University, USA, <http://owl.english.purdue.edu/owl/resource/604/01/>, Accessed November 2007.
6. Spencer, K. A., *Media & Technology in Education*, Chapter 4, Manutius Press, Liverpool UK, 1996, p.23.
7. Olason, Susan C., *Let's get usable! - Usability studies for indexes*, The Indexer, Volume 22 No. 2, <http://www.theindexer.org/files/22-2-olason.pdf>, October 2000.

## UNCLASSIFIED

<b>DEFENCE SCIENCE AND TECHNOLOGY GROUP DOCUMENT CONTROL DATA</b>				
			1. DLM/CAVEAT (OF DOCUMENT)	
2. TITLE  Research Notes – Openness and Evolvability – Documentation Quality Assessment		3. SECURITY CLASSIFICATION (FOR UNCLASSIFIED REPORTS THAT ARE LIMITED RELEASE USE (U/L) NEXT TO DOCUMENT CLASSIFICATION)  <div style="display: flex; justify-content: space-between;"> <span>Document</span> <span>(U)</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Title</span> <span>(U)</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Abstract</span> <span>(U)</span> </div>		
4. AUTHOR(S)  Michael Haddy* and Adam Sbrana (editor)		5. CORPORATE AUTHOR  DST Group Stirling HMAS Stirling PO Box 2188 Rockingham DC WA 6967		
6a. DST Group NUMBER DST-Group-TN-1545	6b. AR NUMBER AR-016-664	6c. TYPE OF REPORT Technical Note	7. DOCUMENT DATE August 2016	
8. Objective ID fAV1121178	9. TASK NUMBER NA	10. TASK SPONSOR NA		
13. DOWNGRADING/DELIMITING INSTRUCTIONS		14. RELEASE AUTHORITY  Chief, Maritime Division		
15. SECONDARY RELEASE STATEMENT OF THIS DOCUMENT  <div style="text-align: center;"><i>Approved for Public Release</i></div>				
OVERSEAS ENQUIRIES OUTSIDE STATED LIMITATIONS SHOULD BE REFERRED THROUGH DOCUMENT EXCHANGE, PO BOX 1500, EDINBURGH, SA 5111				
16. DELIBERATE ANNOUNCEMENT  No limitations				
17. CITATION IN OTHER DOCUMENTS      Yes				
18. RESEARCH LIBRARY THESAURUS  Systems Engineering, Assessments				
19. ABSTRACT These Research Notes form part of a series of notes extracted from work undertaken by Innovation Science in the establishment of Openness and Evolvability assessment Methods and Processes. This set of Research Notes focusses on Documentation Quality Assessment. This work was undertaken from the late 1990s to 2007 and focussed on the application to Submarine Combat Systems.				

UNCLASSIFIED